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Benefits of Using Multicultural Literature to Introduce STEAM Topics to English Learners

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Benefits of Using Multicultural Literature to Introduce STEAM Topics to English Learners

By

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Introduction

In fall of 2015, the National Center for Education Statistics (2015) revealed that nearly 9.5 percent of students were classified as English learners (ELs) in the United States. In some states, over ten percent of students in a general education classroom could be in the process of learning English as their second, third, fourth, or more language (U.S. Department of Education, 2018). Spanish was the home language of over 3.7 million children in the United States in the fall of 2015, accounting for over three fourths of all EL students and making up roughly seven percent of all children in U.S. public schools. Other common home languages of EL students are Chinese, Arabic, and Vietnamese (U.S. Department of Education, 2018). Furthermore, while EL students make up a significant portion of the classroom, they are widely underrepresented in STEM- and STEAM- related occupations after schooling.

The acronym *STEM* stands for science, technology, engineering, and math. More recently, an "A" has been added for the arts to make it STEAM (Cook, Bush, & Cox, 2017; Keane & Keane, 2016). The "A" includes art and design to encourage innovation and include technology tools (Keane & Keane, 2016). Science is the study of information and theories about how our world functions. Technologies are tools that make it easier to live, and engineering is the use of science and math to design structures and tools that make life easier. Finally, mathematics is the study of structure, order, and patterns that result in explanations or solutions. Other terms critical to this project include ELs, multicultural literature and picture books. ELs are students who are in the process of learning English, since English is not their home language (Fan, 2009). Multicultural literature, in general, is writing that includes the sociocultural experiences of underrepresented groups ("Multicultural," n.d.). Finally, picture books are books

for children that contain illustrations ("Picture book," n.d.). The combination and relationship between all of these terms makes for a unique strategy. While STEM is the more commonly used term in many policies and government documents discussing jobs, this project focuses on STEAM and STEAM-related lessons in schools. My hope is that EL students will pursue the STEAM-related field as a result of being exposed to multicultural children's picture books.

It is important to note that STEAM-related occupations are critical in our growing and changing society (Aguirre & Pantoya, 2016; Cook et al., 2017; D'Angelo & Iliev, 2014; Forbringer & Hettinger, 2016; Katrein, 2016; Keane & Keane, 2016). There are about 3.2 million jobs in this field currently available, but, unfortunately, there are not enough qualified people able to fill the positions (Gay, 2013). A career in the STEAM field is a gateway to a successful future; however, it is more difficult to obtain for ELs, who mainly come from minorities and lower income families (Gay, 2013; U.S. Department of Education, 2018). Although this does not apply to every EL, English learners in these situations have a much harder time meeting the qualifications or gaining interest at a young age in order to be put on the right path for these fields. Academic preparation and attitudes have a significant impact on the representation of ELs in the STEAM field.

In order to acquire a STEAM-related career in the future, students must have a passion for STEAM-related fields and complete academic courses that will prepare them for these careers. The level of STEAM courses that students take in high school is predictive of earning a degree in STEAM in post-secondary education (National Science Board, 2018; Riegle-Crumb & King, 2018; Tao, 2018). Additionally, the socioeconomic status and the parents' highest level of education has a strong correlation with the level of math and science courses taken by a student

since “many fully certified mathematics and science teachers [are] less prevalent in high-minority and high-poverty schools when compared with schools with students from higher-income families” (National Science Board, 2018). Also, according to the National Science Board (2018), the achievement gap for STEM subject exams widens throughout elementary schooling. With only 25 percent of Latino students reaching math proficiency and only 13 percent of Latino students reaching proficiency or higher on STEM tests in younger grades, it is crucial for an emphasis to be placed on trying new programs and methods (Gay, 2013). In order to eventually acquire a STEAM-related occupation, students must start early and take higher level science and math courses to set them up for success.

In addition to academic preparation, the attitudes and stereotypes towards STEAM-related fields have a significant impact on the percentage of ELs joining the field. There are many grants and programs, such as summer camps, after-school programs, and youth conferences that have tried to influence a positive change, but many have proven unsuccessful (Gay, 2013; Violino, 2011). The Latino STEM Alliance (LSA) has several hundred volunteers that partner with schools and community groups, but unfortunately, many Latino students do not take advantage of these opportunities (Gay, 2013). Furthermore, earnings of minorities in the STEAM field are significantly lower than those of both white men and women (Tao, 2018). This underappreciation and under-recognition may have a negative impact on the motivation for an EL student to want to join the field. In a study done by Riegle-Crumb and King, the results indicated that if the high school education was similar, there are no disparities between minorities represented in science and engineering majors in college (Riegle-Crumb & King, 2010). It is crucial for schools to introduce STEAM to all children, especially ELs, in a way that

is engaging and encouraging in order to promote positive attitudes and proper academic preparation that set students up for more opportunities in STEAM-related occupations.

The influx of ELs in our country and emphasis on STEAM in our schools has made researchers think about how to introduce STEAM to ELs in an engaging way. What I do in this project is offer a resource for teachers with EL students to easily find multicultural picture books that can be used in their STEAM-related lessons for EL students. The research question that I focused on was: How can multicultural picture books be employed to introduce and encourage the application of STEAM skills to EL students? What follows is a review of literature, my methodologies, my findings, and future directions for research and teaching.

Literature Review

In order for ELs to successfully have an interest in STEAM-related subjects, they must be introduced at a young age and in an entertaining manner. Picture books are an engaging method for pointing out STEAM-related topics in ordinary scenarios, and multicultural picture books are an especially captivating approach for ELs since many of these students can relate to the languages and cultures portrayed in the stories. When they gain confidence and interest in the book, they are more likely to enjoy the STEAM-related ideas. The combination of STEAM and multicultural picture books is not a common approach, but it could be advantageous for EL students. There is very little research on this idea, and in this literature review, I will examine the current practices for teaching ELs STEAM and the current practices of teaching ELs using literature. Then, I will discuss the benefits involved by using multicultural literature in the classroom and the benefits of using picture books to teach STEAM-related fields. Whereas each individual area of the present inquiry has been explored in isolation before, this project combines

multiple research areas in order to investigate how multicultural picture books can be used to successfully introduce STEAM to ELs.

Current Practices of Teaching STEAM to ELs

The STEAM field is very important in today's society, and it encompasses a large portion of today's careers (Aguirre & Pantoya, 2016; Cook et al., 2017; D'Angelo & Iliev, 2014; Fehr, Moore, Pettis, & Tak, 2013; Forbringer & Hettinger, 2016; Katrein, 2016; Keane & Keane, 2016; Monhardt & Monhardt, 2006; Owens & Rehmat, 2016; Serafini, 2015). Doctors, engineers, computer programmers, data analysts, and psychologists are all examples of careers that rely on STEAM. It is critical for schools to teach these subjects and promote their importance to all students. There are a variety of different methods for teaching STEAM in schools, especially for EL students (Besterman, Ernst, & Williams, 2018; Casey, Mireles, Selina, Viloria, & Garza, 2018; Diego, Briceño, & Basaraba, 2018; Faggella-Luby, Griffith, Silva, & Weinburgh, 2016; Wilson, Copeland-Solas, & Guthrie-Dixon, 2016). The traditional approaches of teaching STEAM include rote vocabulary memorization and concept lectures (Harper, 2017). The more current ways of teaching STEAM to EL students include project-based learning, collaborative groups, mind mapping, retellings, and literacy integration.

Project-Based Learning

One of the more interactive ways to introduce STEAM topics to a class is through project-based learning. Project-based learning is a teaching method in which students gain knowledge and skills by using critical thinking techniques to solve a problem or investigate a situation (Harper, 2017). This pedagogical approach became popular when STEM-related fields first became a focus in U.S. schools (Besterman et al., 2018; Harper, 2017). The use of group

interaction is key to allowing students to better understand scientific concepts and use academic terminology in a real world scenario (Cook et al., 2017; Harper, 2017). Students learn from every exploration, regardless if they were able to solve the initial problem or not (Harper, 2017). Project-based learning can be effective for EL students since they are practicing English while communicating with peers and engaging in activities that are applicable to their everyday life (Besterman et al., 2018; Casey et al., 2018). This strategy holds many benefits for introducing STEAM to ELs and capturing their interest.

Collaborative Groups

Similar to project based learning, group collaboration is another current practice of introducing STEAM-related fields to ELs. Group collaboration is helpful in any content area for EL students because they get to listen to their peers' perspectives and practice using language in a small group setting (Besterman et al., 2018; Casey et al., 2018; Fagella-Luby et al., 2016; Wilson et al., 2016). Collaborating with peers helps build meaningful relationships and supports relevant learning (Besterman et al., 2018). By working with others on STEAM-related activities, EL students have shown a deeper understanding and more motivation (Besterman et al., 2018; Wilson et al., 2016). Group collaboration is a helpful strategy for EL students during STEAM-related activities since they are able to gain confidence and become more motivated.

Mind Mapping and Retellings

Other current practices for teaching EL students STEAM include mind mapping and retellings. Mind mapping is a way to visually organize information and show relationships among ideas (Wilson et al., 2016). It can be very helpful for EL students who are artistic or visual learners. Mind mapping allows instructors to offer immediate feedback to any

misconceptions and has shown that students are more motivated and responsive as a result (Wilson et al., 2016). Retelling is another similar strategy that is better for auditory learners. Retellings are a strategy that all students, including ELs, can use to summarize what they have learned and strengthen concept understanding (Fagella-Luby et al., 2016). Both mind mapping and retellings are easy to implement in the classroom and can benefit STEAM instruction and assessment for EL students who prefer visual or auditory learning styles.

Literacy Integration

Literacy integration is another way to introduce STEAM to ELs. By integrating literacy with STEAM-related skills, EL students are able to improve their language while being introduced to STEAM (Diego et al., 2018). Some studies have shown that this actually improves EL's overall comprehension (Casey et al., 2018). While it may be beneficial, this area is severely under-researched. One of the goals of this project is to use literacy integration with STEAM by using multicultural picture books. The current literature seems to indicate that there would be positive results since integrating English language arts (ELA) with STEAM has had a positive outcome (Casey et al., 2018; Diego et al., 2018). It is also important to note that while STEAM may already include ELA under its "A," or art, discipline, literacy can relate to additional areas. Literacy integration can be an especially powerful strategy for introducing STEAM-related fields because many EL students are using literature already to develop their use of the English language and to promote understanding of all subject areas.

Current Practices of Teaching ELs Using Literature

It is crucial for ELs to be engaged with literature as much as possible in order to develop their ability to use the English language. They may be familiar with some aspects of the story

and visual imagery which could improve vocabulary. This familiarity comes from background knowledge about a story or the idea that many stories are narrative in nature. Literature can also model both social and academic uses of English in context. It is important that teachers use many different teaching techniques in order to find the best one for each student. Conducting read alouds, pairing books, and using picture books to introduce topics are three ways to successfully use children's literature to aid EL students in all academic subjects.

Conducting Read Alouds

Read alouds can be a successful tool for beginning ELs. When a teacher conducts a read aloud, there is a sense of belonging in the class since all of the students are gathering together, listening to the same story, and watching the same teacher (Fan, 2009). Many ELs do not get to experience the whole day with the rest of their class, but during read alouds, everyone gets to participate (Besterman et al., 2018; Fan, 2009). Also, read alouds are a great opportunity for teachers to model language use (Fan, 2009; Yeom, 2018). EL students will experience how words are pronounced and relate the facial expressions or intonation a teacher uses for different emotions expressed by the language (Aguirre & Pantoya, 2016; Yeom, 2018). It is important for ELs to have a model for both academic and social language (Hansen, Auproux, Brown, Giarretto, & Worthington, 2015). Lastly, children's literature is narrative in nature and will catch the attention of an EL student by telling a story or painting vibrant pictures (Aguirre & Pantoya, 2016; Fan, 2009; Yeom, 2018). Since STEAM-related topics are typically unfamiliar, read alouds from books incorporating STEAM ideas could greatly benefit EL students in the classroom.

Pairing Books

Similar to read alouds, book pairing is another acknowledged method to catch the attention of an EL student while benefiting their education. In a book pairing, a teacher will select two books that contain similar topics, but may involve any content area, such as science. Typically, one book is nonfiction and the other is fiction; however, the main goal is for one book to directly relate to the academic lesson while the other serves as support (Fan, 2009; Hansen et al., 2015; Klefstad & Martinez, 2013; Yeom, 2018). The supporting book is one that interests and motivates the student. The two books must relate to each other in such a way that they build the student's overall understanding about a topic by connecting ideas (Hansen et al., 2015; Yeom, 2018). Through the process of book pairing, students can see the overlapping concepts and create their own ideas.

Additionally, book pairing reinforces both social and academic language. The supporting book is usually narrative in nature and may model social language (Hansen et al., 2015). On the other hand, the fact-based text will model academic language (Aguirre & Pantoya, 2016; Hansen et al., 2015). By reading about the same topic in both social and academic language, the student will better understand how to implement both in the classroom. In addition, teachers may add a sharing portion to an assignment to further reinforce social language (Fan, 2009; Hansen et al., 2015; Hillman, 1995). By pairing two books about one topic, EL students learn how to make connections and improve both their social and academic language. While there is no current research, book pairing using multicultural literature could be a great way for teachers to introduce STEAM-related topics.

Using Picture Books to Introduce Topics

Picture books are a powerful tool for introducing new topics to EL students. They can be used as a lesson opener or as a resource during an activity (Forbringer & Hettinger, 2016; Smallwood, 1998; Yeom, 2018). Because of their narrative style and alluring visuals, picture books are quick to catch the attention of a student (Aguirre & Pantoya, 2016; Fan, 2009; Forbringer & Hettinger, 2016; Monhardt & Monhardt, 2006; Smallwood, 1998). Narrative writing is more familiar to many students, and when combined with stimulating pictures, EL students become inspired to participate in a lesson, even one with an unfamiliar topic (Aguirre & Pantoya, 2016; Fan, 2009; Hansen et al., 2015). For this reason, it could be beneficial for STEAM-related topics to be introduced to ELs through this method. In addition to catching a child's interest, picture books also help EL students gain confidence. Many picture books use predictable or rhyming language, which helps the student better understand the text (Fan, 2009; Smallwood, 1998). Picture books are also filled with images that can provide visual clues to a student who is struggling to understand the language describing a concept (Smallwood, 1998; Yeom, 2018). Finally, many picture books have simpler themes that make them easy to comprehend and apply to a scenario (Fan, 2009; Hansen et al., 2015; Smallwood, 1998). When students have a better foundation, they can have more confidence learning a new topic (Aguirre & Pantoya, 2016; Hansen et al., 2015; Yeom, 2018). Picture books are a great way to help EL students get interested and gain confidence about new topics during a lesson, and this method can be used to introduce STEAM to ELs.

Benefits of Using Multicultural Books in the Classroom

A multicultural book is one that includes the sociocultural experiences of underrepresented groups ("Multicultural," n.d.). Multicultural books may include characters and

themes from around the world, which may make them relatable and comfortable for ELs (Aguirre & Pantoya, 2016). Many multicultural picture books also have STEAM-related topics embedded throughout them. Teachers should use this to their advantage by selecting multicultural picture books for EL students that will simultaneously introduce STEAM-related ideas. In addition to aiding ELs, using multicultural picture books in the classroom is a widely underrepresented idea that holds many benefits for all students. Many of the picture books and other children's literature in today's libraries reflect a white, European culture. Although it is becoming more common, multicultural literature is quite marginalized ("Multicultural," n.d.). Multicultural literature may lack the amount of STEAM-related content that other books might include, but they still contain enough for an introduction to basic STEAM skills. Multicultural books have the ability to evoke personal reader responses, build self identity, develop an appreciation for other cultures, and value cognates.

Evoke Personal Reader Response

Through the use of multicultural picture books, students gain the ability to develop empathy, evaluate authenticity, and expand their critical thinking skills. Most multicultural books depict diverse cultures that are very different from students in today's classrooms (Klefstad & Martinez, 2013; Smallwood, 1998; Wang, 2017). Even though they have different cultures and worldviews, many characters undergo similar situations that students might experience. For example, in *Puddle* by Hyewon Yum, a young boy can not go outside to play because it is raining. He has to find things inside to do and ends up strengthening his bond with his mother. Stories like this use multicultural backgrounds, but contain everyday experiences that many students can relate to. By including relatable experiences, multicultural books can build

understanding and empathy for others (Smallwood, 1998; Wang, 2017). Additionally, multicultural books can lead to discussions of authenticity. The depiction of cultures in these stories can evoke a personal reader response, which can help readers develop appreciation by gaining a better intercultural understanding. This, in turn, may lead to research in the classroom in order to evaluate authenticity and accuracy (Montelongo, Hernández, & Herter, 2014; Wang, 2017). By completing activities like this, students are expanding their critical thinking skills and may begin to develop the skills required to become a global citizen in today's world. Although developing global citizenship is is not the primary focus of this work, it is a possible benefit from using multicultural books. Evoking personal reader response is an outcome that teachers should use to their advantage.

Build Self Identity

In addition to evoking personal responses, multicultural literature also educates students on the importance of culture. Students are able to learn what culture is and build their self-identity through discussions of culture through diverse children's books (Klefstad & Martinez, 2013; Smallwood, 1998; Wang 2017). Multicultural literature gives students the opportunity to reflect on the meaning of culture and its use in their everyday lives. For example, they may be able to see similarities and differences between themselves and characters from the stories (D'Angelo & Iliev, 2014; Montelongo et al., 2014; Smallwood, 1998; Wang, 2017; Yeom, 2018). Bao Phi's *A Different Pond* tells the story of a young boy who goes fishing each morning with his father. While the specific activities they engage in show that their culture might be different, the relationship between son and father is similar to the one many students can relate to. In some cases, students from diverse backgrounds may feel a sense of belonging in the

classroom (Klefstad & Martinez, 2013; Wang, 2017). Discussions of culture can increase motivation in the classroom as students begin to develop their self-identity and discover how they fit into the community and world (D'Angelo & Iliev, 2014; Klefstad & Martinez, 2013; Montelongo et al., 2014; Smallwood, 1998). Multicultural children's literature provides a unique opportunity for students to learn more about global cultures, including their own, and ultimately gain a better sense of identity.

Develop an Appreciation for Other Cultures

When students are able to find opportunities to build on their own self identity, they also may begin evaluating and appreciating other cultures in the classroom and around the globe. By learning more about other cultures through the use of diverse children's literature, students can begin to appreciate differences and strive to learn even more about them (Klefstad & Martinez, 2013; Smallwood, 1998; Wang, 2017). Many students may take on an "insider perspective" when reading literature written in the first person (Wang, 2017). This allows the student to appreciate others values and beliefs in addition to gaining a better understanding of life styles and hardships around the world (D'Angelo & Iliev, 2014; Klefstad & Martinez, 2013; Montelongo et al., 2014; Smallwood, 1998; Wang, 2017). This process requires students to keep an open mind and evaluate situations that might not be normal to them.

By developing an appreciation for other cultures globally, students may also learn to appreciate the blend of unique cultures in their own classroom. Many EL students feel more included in class activities and discussions that involve cultures they are more familiar with (Fan, 2009; Klefstad & Martinez, 2013). Additionally, learning about diverse backgrounds can prompt evaluations of authenticity in books and ultimately, the role of stereotypes (Klefstad & Martinez,

2013; Wang, 2017). Discussion of stereotypes is important for children to think about as they grow and develop their own views on the world. One last way that multicultural literature can lead to the appreciation of other cultures is by making real world connections (D'Angelo & Iliev, 2014; Klefstad & Martinez, 2013; Montelongo et al., 2014; Smallwood, 1998; Wang, 2017). A great way to do this is to watch or invite in guest speakers, especially from the local community, who might share a new cultural idea or make connections with multicultural book for students (Klefstad & Martinez, 2013). Reading diverse picture books in the classroom holds many benefits for young children to begin their appreciation of other cultures and take pride in their own.

Value Cognates

Cognates are words that have similar linguistic derivations from each other. An example of a cognate is the English word "artist," and the Spanish word, "artista," which both describe a person who does art (Montelongo et al., 2014). Since multicultural literature can represent cultures and languages all over the world, some multicultural literature will use cognates, and some may even be completely bilingual (Montelongo et al., 2014). For students who are in the process of learning English or another language, bilingual books or books with cognates can aid in the development of academic vocabulary (Fan, 2009; Hansen et al., 2015; Montelongo et al., 2014). In addition to ELs, diverse multicultural literature filled with cognates can help struggling readers and writers make connections or serve as a mentor text, which is an example or model for students to refer to when writing. Picture books with cognates and simpler language have many benefits that traditional literature may lack (Fan, 2009; Hillman, 1995; Klefstad & Martinez, 2013; Montelongo et al., 2014; Smallwood, 1998). Diverse picture books can serve as

a vehicle for students to make connections to their world and STEAM ideas inside and outside of the classroom.

Benefits of Using Picture Books to Teach STEAM

While there is not much research specific to EL students and introducing STEAM with picture books, there are many benefits to using children's literature to help introduce STEAM-related concepts in the general classroom. Many teachers and researchers would argue that this may be one of the best ways to introduce STEAM skills to younger students (Brant, Buchanan, Carr, Weiss, & Wentz, 2001; D'Angelo & Iliev, 2014; Flevares, Sackes & Trundle, 2009). It also helps increase understanding of these topics with older students (Brant et al., 2001; Jewett, Johnson, McKoy Lowery, & Stiles, 2015). Picture books are literature for children that contain illustrations ("Picture book," n.d.). Though there is not much research for benefitting EL students or using multicultural picture books, there are still many positives to take away from this strategy. Some of the overall benefits include increasing motivation, providing meaningful background context, allowing for scaffolding, awakening curiosity, and making class time more interdisciplinary in nature.

Increase Motivation

When teachers use picture books to introduce a STEAM lesson, students will be able to learn STEAM-related concepts easier, and this can overall boost their motivation towards learning STEAM ideas in general (Brant et al., 2001; D'Angelo & Iliev, 2014; Katrein, 2016; Pantoya, Aguirre-Munoz, & Hunt, 2015). Understanding the underlying content from the literature makes students feel more comfortable with skills that they will need in the future. This comfort increases motivation to do well again (Brant et al., 2001; Pantoya et al., 2015). In

addition, picture books typically take on an enjoyable, narrative form that may increase the motivation of a student to engage in a STEAM-related activity (Fehr et al., 2013; Flevares et al., 2009; Pantoya et al., 2015; Yeom, 2018). As an example, students used the engineering design process to create hamster habitats after reading books about a hamsters and habitats for animals (Fehr et al., 2013). Students are more likely to participate in activities that are enjoyable and familiar to them. Also, since the students become more aware of STEAM-related skills in their everyday life as a result of witnessing it in literature, they realize how important it may be in their own life (Katrein, 2016; Owens & Rehmat, 2016; Pantoya et al., 2015). Comfort with STEAM material as a result of introducing it with a picture book may increase a student's enthusiasm towards studying STEAM in the classroom and in the future.

Provide Meaningful Background Context

Picture books provide students with background context to begin thinking about STEAM-related ideas. When a student understands a concept from literature, they can better understand STEAM topics associated with those concepts (D'Angelo & Iliev, 2014; Fehr et al., 2013; Flevares et al., 2009; Forbringer & Hettinger, 2016; Katrein, 2016; Monhardt & Monhardt, 2006; Owens & Rehmat, 2016; Pantoya et al., 2015; Serafini, 2015). For example, math problems can become more relevant and applicable when they are explained using a simple story with pictures (D'Angelo & Iliev, 2014; Forbringer & Hettinger, 2016). Science lessons can become more meaningful when a character also must undergo the scientific method (Monhardt & Monhardt, 2006). Literacy can help support STEAM lessons to provide students with meaningful context.

Literature also helps students become more familiar with vocabulary and complex ideas that may be brought up in STEAM lessons. The picture books provide many clues both with visual images or simple text (Brant et al., 2001; Flevares et al., 2009; Smallwood, 1998; Yeom, 2018). This is also a current strategy in today's' classrooms for teaching ELs using literature. Many STEAM topics cover uncommon, frightening words. With meaningful background content, these words and ideas can be less intimidating. Similarly, some STEAM-related ideas may be rather complex. When put in narrative form, the ideas may become more manageable to comprehend for students (Brant et al., 2001; Flevares et al., 2009; Pantoya et al., 2015; Yeom, 2018). This is especially true when the complex ideas or processes are depicted through pictures (Pantoya et al., 2015; Yeom, 2018). Overall, children's picture books can aid students' understanding by supplying meaningful context, simpler language, and helpful illustrations.

Allow for Scaffolding

Picture books can be used as a tool for teachers to scaffold many STEAM lessons. They can benefit each student in the class in different ways. For struggling or unmotivated readers, picture books can be an effective device. These readers may be more drawn to the visual elements of a picture book, which can teach STEAM-related concepts (Brant et al., 2001). This could also benefit the visual learners or ELs in a classroom. Struggling readers also may lack the ability to comprehend as easily as other students (Brant et al., 2001; Forbringer & Hettinger, 2016). By introducing STEAM-related concepts with a picture book, the teacher may be able to bridge the gap between the context of a story and an assignment (Brant et al., 2001; Katrein, 2016). Finally, struggling or unmotivated readers may get more enjoyment out of completing STEAM activities that require less reading skills (Brant et al., 2001; Jewett et al., 2015; Katrein,

2016; Pantoya et al., 2015). This could ultimately drive their academic interests towards STEAM-related areas.

For higher level thinkers in the class, picture books combined with STEAM lessons can provide an extra challenge. In a Genius Hour study conducted by Katrein (2016), students in fifth grade were given time each week to investigate STEM-related concepts in a picture book of their choice. They then selected a project to complete based off of the concepts in their stories. Katrein found that students became more interested in STEM-related fields in their everyday life and became more motivated to find connections between picture books and real life experiments. An individual, experimental project such as this one could be perfect for students who may need enrichment in the classroom (Hillman, 1995; Katrein, 2016). Children's literature can be used to both support and challenge students learning about STEAM-related fields.

Awaken Curiosity

Similar to the way picture books can increase motivation, they can also awaken students' curiosity to STEAM. Because children's literature is generally narrative in nature, it may catch children's attention quicker than a more academic lesson (Brant et al., 2001; Forbringer & Hettinger, 2016; Pantoya et al., 2015). Picture books incite enthusiasm while introducing fundamental ideas. Furthermore, these lessons may lay the groundwork for students to explore topics further. If the children finds the ideas intriguing, they will be more likely to do more research on their own (Monhardt & Monhardt, 2006; Owens & Rehmat, 2016; Pantoya et al., 2015). This could lead to a lifelong interest or possible career path (Katrein, 2016; Owens & Rehmat, 2016; Pantoya et al., 2015). By making an introduction to STEAM skills more fun,

picture books could ultimately inspire any student, including an EL, to pursue a STEAM-related field in the future.

Make Class Time More Interdisciplinary in Nature

In addition to all of its other benefits, using picture books to introduce STEAM-related topics to students gives them experience with interdisciplinary activities at a young age. Combining STEAM topics with literature requires a broad use of skills (Monhardt & Monhardt, 2006; Pantoya et al., 2015). Enjoyable stories have more meaning when students can better understand the STEAM skills associated with the lesson. Problem solving techniques that characters use might model the scientific process or engineering design process (Monhardt & Monhardt, 2006; Owens & Rehmat, 2016; Pantoya et al., 2015). When students can make these connections, their education and preparation for the real world grows (D'Angelo & Iliev, 2014). The mixture of universal skills with literature can be very beneficial as it requires a good understanding of interrelationships. Additionally, time for STEAM may be more limited for EL students due to language instruction, so using interdisciplinary approaches like this can be extremely beneficial.

Benefits of Using Multicultural Picture Books to Introduce STEAM skills to EL Students

While there is not much research on the idea of using diverse multicultural picture books to introduce STEAM-related skills to EL students, there are many possible benefits that stem from this concept. The current ways of teaching EL students STEAM and using literature in the classroom are appropriate, but there is a better method. After examining current literature on current practices and their benefits, I believe that using multicultural literature to introduce STEAM to ELs is a best practice and should be an area of research in the future.

Picture books provide EL students with much needed background context for generally unfamiliar ideas. The story format and multicultural ideas presented provide a stable base for the student to begin their learning upon. While STEAM-related skills may be unfamiliar, there are many familiar elements for them to lean on for support. For example, a character may engage in the scientific method and make it easier to relate to through illustrations. Also, the illustrations in a diverse children's literature book may help EL students learn new vocabulary and ideas necessary for STEAM lessons.

The use of a picture book also helps EL students increase motivation and gain confidence needed to complete STEAM-related field activities. The picture books provide teachers with a method of scaffolding these lessons. When EL students understand tough STEAM topics, it may feel rewarding and provide positive reinforcement. Additionally, multicultural literature may appeal to ELs cultural backgrounds and add more relevance to their life than standard STEAM lesson plans. Finally, the use of diverse picture books may incite curiosity for further study of STEAM-related concepts for many EL students. When ELs comprehend these topics, they may become more curious and passionate towards the STEAM field. Ultimately, this could result in more ELs put on the path towards STEAM-related careers. This could cause major changes in the STEAM industry, so it is important for scholars and teachers to make this an area of future research.

Project Design

After examining the literature, the goal of my project was to examine award-winning multicultural picture books in order to create a resource for teachers to use with their EL students. I wanted to create an accessible website for teachers to access diverse, award-winning

picture books and their related STEAM topics in order for teachers to support students' further investigations of STEAM-related concepts. The resource I created is located at the following link: https://wilkinsonk1.wixsite.com/steam4ells

Book Selection

Once I had my idea, I had to narrow down the award-winning books that I would be including. Since there are so many multicultural books, and I wanted to avoid any kind of bias by only including multicultural books from a specific library, I had to limit my selection based on some type of criteria. For these reasons, I chose to limit my book selection to multicultural book winners from recent years. I ultimately included the winners of the Asian/Pacific American Award for Literature picture books from 2015/2016, 2016/2017, and 2017/2018, the Coretta Scott King Award for illustrators in 2016, 2017, and 2018, the Pura Belpre Award for illustrators in 2016, 2017, and 2018, and the Tomas Rivera Mexican American Children's Book Award for 2016, 2017, and 2018. When combined, these books cover many different cultures. I obtained these twelve books and read through them once. Then, I read through each a second time, and recorded all STEAM-related concepts that were present. I recorded these concepts on a chart. The chart was organized by book and the areas of STEAM (science, technology, engineering, arts, and mathematics). The chart also included a summary for each book. Every reference to a STEAM-related area was recorded with the page number. When I was finished recording all STEAM examples, I went back and highlighted the most important or prominent ideas to include in my website.

Website Design

I chose to utilize Wix to create my resource. I wanted to organize the information by tabs. I chose to have a "Home" tab to introduce the website and give some background information of my research. It also explains how the website is organized and provides a link to my full thesis. The next tab is the "About" tab. This includes some information on me so that users of the site know my experience and goals. In addition, there is a place for users to provide feedback on the resource so it can continue to be updated in the future.

The organization of the remaining website tabs would be similar to the organization of my book analysis chart by using one tab for each content area of STEAM. This posed a problem since the fundamental idea of STEAM is that these five areas are interrelated. By splitting up these areas in my chart and my website, I was going against the whole purpose of STEAM. I justified this decision by deciding that some of the books could go under multiple tabs making them interdisciplinary. Additionally, if teachers were using this resource to find a lesson plan for science, it would be most convenient for them to go right to a science tab to find science lesson ideas. Although some of the concepts overlap, I broke apart the areas of STEAM in order to organize the ideas that were included in the multicultural award winning books.

After collecting my data, I wanted to include my entire chart with all of the possible STEAM lesson ideas, but I focused on limiting the number of lesson ideas I put directly on my website. I used the highlighted, prominent STEAM-related lesson topics, and I included these lesson ideas along with the book cover, title, author, illustrator, and award won on the respective tab of STEAM. Originally, I wanted to list the lesson idea as "potential lesson plan," but since I was not including a full lesson plan for each idea, I changed this to read "technology topic" or "science topic" for each idea depending on the tab. This way, teachers can easily observe the

main lesson ideas that correspond to each book. Additionally. each lesson idea is listed sequentially on the website tab. On each tab, the lesson ideas start out most basic and get more advanced as book titles travel down the page.

Website Feedback

The design of my website was informed by research on website design. I used this research to then get feedback on my resource. I found two sources about website design to help me make adjustments to my site. Both sources recommended having others review the site and respond to a series of focused questions. They highlighted presentation and accessibility in order to have a successful website. Zhang and von Dran (2000) recommended asking specific questions that have a yes or no answer, such as "are you motivated to come back?" I created a survey for others to take to provide me with feedback on the presentation, accessibility, and applicability of the website. I posed the following questions and prompts: Are the directions for navigating the site clear? Do the links work? Is there an appropriate coverage of information for the topic? Could you see the website being a resource for your class in the future? Were the books interesting and/or appropriate for your students? Were you motivated to return to the resource at another point in time? I sent the form to current teachers, education professors, and undergraduate education students. I received feedback from eight of these people, including six current teachers, one professor, and two undergraduate education students.

The feedback I received from my survey has helped me make adjustments to my website. I decided to add another tab: "The Books." This tab includes all twelve books, organized by their multicultural award and then their winning year. The awards each contain a link to their awards' website. Under the award, each book includes a picture along with its author, illustrator, and

summary. At the top of this page, I also include a link to the full chart with all of my data. This will help teachers gain more information on the books if they were to use them in their classroom. I received a lot of positive feedback from this survey. Current teachers said it was "easy to use" and "very organized and professional." Future educators responded that they would "absolutely" use this as a resource in their future classroom. I received additional ideas such as linking the books' Amazon pages to their titles and linking or writing lesson plans for each lesson idea. These are definitely great ideas that I want to employ in the future. It is important to me to continue to update the resource to make it as convenient and meaningful as possible for teachers.

Results

After completing this project, there are several conclusions I was able to make. First, there are not many multicultural books that are centered around STEAM-related concepts. Out of all twelve books I evaluated, *Lowriders to the Center of the Earth* was the only book that was predominantly about a STEAM-related idea. All of the other books contained STEAM concepts, but they were not included in the main idea of the book. Additionally, engineering and technology topics are greatly underrepresented in multicultural books. The examples of these two ideas in the books are severely less than the number of science or math topics. Most of the engineering lesson ideas were related to buildings or structural designs. Many technology examples were related to tools used in the books. The books contained an average of four to five engineering topics in relation to an average of seven to ten science topics. The science topics are also much more diverse. I struggled to find examples of engineering and technology in almost every book. I found that science was the more prominent STEAM-related concept found in

multicultural literature. I believe that this was the case since many of these books featured animals or other living things. They also had a lot of outdoor settings that included trees and skies. Science was the easiest STEAM discipline to introduce with multicultural literature, followed closely by mathematics. There were several science examples that could be used in lower grades, even kindergarten. For example, multiple books included the sun. For math, the easiest concept embedded in these multicultural books was counting or tapping rhythmic patterns. Hopefully, in the future, there will be more examples of all areas of STEAM represented in multicultural books.

Discussion

It is crucial for EL students to be introduced to STEAM at a young age in order to set them up for success later. Teachers can influence ELs' interest and motivation for learning more about STEAM-related skills and occupations by introducing it in engaging ways. Using multicultural literature can help teachers find engaging ways to introduce STEAM to their EL students, as well as their other students. Because of the many benefits that result from using multicultural books in the classroom and using picture books to introduce STEAM, using multicultural literature to introduce STEAM to ELs could also have many benefits.

Upon completing my resource, I have some recommendations for the future. Firstly, I believe that multicultural literature should include more STEAM-related ideas. It would be helpful if future books could focus more directly on these concepts, especially engineering and technology. I also recommend that more books include STEAM as a central topic of their book. Although it is possible to find small examples of STEAM in every book, it is critical to show students the importance of the STEAM-related field by focusing more on it in literature. The

more it can be included in multicultural books, the bigger impact it will have on students. In addition to these recommendations, I believe more research needs to be done in the inclusion of literacy integration with STEAM. This is especially significant for multicultural literature and the effect this strategy could have on EL students.

As my resource continues to change and grow, I have a few areas I will focus on in the future. My next task is to add the 2019 multicultural award book winners. This will add four more books and their STEAM-related topics to my website. Additionally, I would like to include links to the books' Amazon pages so that teachers can easily order the books for their classroom. I would also like to keep up with current research on this topic. Since there is no other research out there about the benefits of using multicultural literature to introduce STEAM to EL's, I hope to stay up to date on research that may impact this field.

This project has helped me think about my perspective as both a researcher and a teacher to employ this topic in my own future classroom. I hope to be able to employ these multicultural books to introduce and engage all students, especially ELs, in STEAM lessons in the near future. In my future classroom, I plan on including multicultural picture books, and integrating them with STEAM when I am able. I would really like to observe how students respond to this strategy. If I have EL students in my classroom, I would like to interview them before, during, and after using multicultural books to introduce STEAM-related ideas. I would also monitor their growth in STEAM content and language development to compare with previous EL students' growth without multicultural picture books. Extending this research into my own classroom would help me discover new strategies and ideas about teaching EL students. This research has already helped me craft new ideas about the way I think about introducing and teaching STEAM

to all students. Although there are many different strategies, not all of them are successful or as successful as they need to be. It is important for all teachers to be flexible and try strategies that will benefit all of their students, including ELs.

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